IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No. :..... 10/783,174 Confirmation No. 7299

Applicant : ....Rhodes et. al.

Filed :... February 20, 2004

TC/A.U. :.. 1752

Examiner : .... CHU, John S. Y.

Docket No. : ....PHR203-0004 US

Title : Method of Controlling the Dissolution Rate of Cycloalkyl Polymers and Monomers Used for Making Such Polymers

DECLARATION UNDER RULE §1.132

Assistant Commissioner for Patents
Washington, D. C. 20231

Sir:

I, Andrew Bell of 1511 Lewis Drive, Lakewood, Ohio 44107, hereby declare as follows:

1. I am Technology Director for Semiconductor Packaging at Promerus LLC, 9921 Brecksville Road, Brecksville, OH 44141-3289. I hold a B.Sc. in Inorganic Chemistry from The University of Bath, England (1980) and a Ph.D. in Organometallic Chemistry from Purdue University (1985). I also completed a postdoctoral fellowship at Massachusetts Institute of Technology, where I studied macrocyclic synthesis and small molecule activation (1985-1987). After finishing my postdoctoral fellowship, I worked as a research scientist in the fields of dicyclopentadiene reaction injection molding and Group VI organometallic chemistry (Hercules Incorporated, Wilmington, Delaware, 1987-1994). I have also performed research and development in the area of polycyclic olefin polymerization chemistry with a focus on nickel and palladium addition polymerization of polycyclic olefins (The BF Goodrich Company, Brecksville, Ohio, 1994-2000). As Vice President of Technology for Cymetech, LLC, headquartered in Huntsville, TX, I directed the development of new catalysts and commercialization efforts involving the 2005 Nobel Prize related ruthenium alkylidene

complexes and norbornene- and dicyclopentadiene-based polymers (March 2000-April 2001). Since 1994, I have worked on the synthesis and reactivity of mono- and bis-functionalized stereospecific norbornene monomers via the isolation of pure exo- and pure endo- starting materials useful in ring-opening metathesis polymerization (ROMP) and addition-polymerization. I am an inventor or co-inventor of more than 15 U. S. Patents and international patent applications covering a wide range of subject matter in the fields of polymer science and catalysis. I am also an author or coauthor of numerous scientific articles dealing with polymer chemistry related to the ROMP of cyclic olefins, tungsten and molybdenum aryloxide and alkoxide chemistries, macrocycle synthesis and metal complexation, and Group 6 and Group 12 isocyanide α-diimine derivatives.

2. I have reviewed the Office Actions mailed March 2, 2006 and May 13, 2005 that are directed to the above-referenced Application as well as the application itself. Such review was directed primarily to the current Office Action's rejection under 35 USC § 112, second paragraph. The claims specified as being rejected thereunder are Claims 1-8, but as Claim 2 is no longer pending and Claims 9-11 depend from Claim 5, my remarks and conclusions relate to Claims 1 and 3-11 as well as those portions of the Detailed Description of the Application that are related to the ratio of exo to endo isomers of substituted polycyclic olefin monomers derived from a Diels-Alder reaction of an appropriate dienophile with an appropriate diene.

3. Claim 1 as currently amend recites (and Claim 5 includes language analogous thereto):

> A photoresist composition comprising a polymer having a desired dissolution rate, said polymer comprising at least one polycyclic olefin derived type of repeat unit having a desired exo mole percent, where the desired exo mole percent is greater than or less than the expected exo isomer mole percent for a polycyclic olefin monomer from which the polycyclic olefin type of repeat unit is derived, such expected exo isomer mole percent based on the thermodynamic equilibrium of the isomers of such monomer that are obtained from a Diels-Alder reaction used to form such monomer.

4. It is my understanding that current Office Action holds that Claims 1-8 are believed to be indefinite with respect to the portions of Claims 1 and 5 cited in the current Office Action, specifically, "[where the] desired exo mole percent is greater than or less than the expected exo isomer mole percent for a polycyclic olefin monomer."

Further to this holding of indefiniteness the Office Action maintains that:

(a). conditions for deriving the monomers from the Diels-Alder reactions are unclear as to the precursors used;
(b). the preparation for polymerization can alter the mole percent of the isomer content away from the expected mole percent;
(c). as the claims do not specify the precursors used, they do not provide guidance as to the expected isomer formation; and
(d). the lack of the amounts of the isomer components used to polymerize the units creates an ambiguous scope.

5. I disagree with this holding for several reasons, first of which is that the rejection seems to be based on only the portion of Claims 1 and 5 that is quoted in the Office Action. Thus, while mention is made of the named Diels-Alder reaction that appears in the unquoted portion of the claim, no consideration of the language from that unquoted portion, specifically: "such expected exo isomer mole percent based on the thermodynamic equilibrium of the isomers of such monomer that are obtained from a Diels-Alder reaction used to form such monomer" is acknowledged in the Action as being considered in making the rejection. As this language defines an "expected exo isomer mole percent" in terms of the equilibrium exo mole percent for a Diels-Alder reaction that would result in making the monomer, the language of Claim 1 when taken in its entirety is, I believe, clear, definite and would be readily understood by one of ordinary skill in the chemical arts.

Referring to 3 (a), the Diels-Alder reaction is well known to those of skill in the chemical arts to involve the reaction of a dienophile and a diene to form an adduct thereof. Therefore, to form a polycyclic olefin monomer, for example one of the monomers disclosed in paragraphs [0024] through [0031] of the application, for use in forming the at least one repeat unit recited in Claims 1 and 5, any person of ordinary skill in the chemical arts would be able to select the appropriate dienophile and diene that are needed to form a specific polycyclic olefin monomer via a Diels-Alder reaction. For example, where the monomer α, α-bis (trifluoromethyl)bicyclo[2.2.1] hept-5-ene-2-ethanol (HFANB) is desired, it would be known to the skilled artisan that cyclopentadiene (CPD) and allyl hexafluroalcohol are appropriate precursors for making HFANB via a Diels-Alder reaction. In addition, as there is over 75 years of reported Diels-Alder reaction and related product characterization data available to a skilled artisan, I believe that such data, when combined with routine experimentation, is a sufficient resource to make the selection of reaction conditions and precursors a routine task. Hence I believe that it is irrefutable that Office Action's statement, shown in 3(a) is incorrect.

Turning now to 3(b), the Office Action's alleges that "the preparation for polymerization" can alter the mole percent of the isomer content away from that which is desired. This statement is unclear as to its meaning.

If the statement refers to the conditions used for the Diels-Alder reaction then of course different reaction conditions will provide different initial isomer ratios. Referring to an article found at Wikipedia.org, specifically at *http://en.wikipedia.org/wiki/Thermodynamic_reaction_control* (provided herein as Attachment 'A') it is seen that it is well known that different reaction conditions can result in different products being formed where the starting precursors are the same (see, Example). It is also seen, that ,"[t]hermodynamic reaction control takes place with vigorous reaction conditions or when the reaction is allowed to continue over a long time to give a slow reaction time to reach equilibrium" (see, second paragraph) since the product formed under thermodynamic control is the more stable of the two competing products. Thus, I believe that comparing the *desired* exo mole percent to that which is *expected* when the reaction reaches thermodynamically controlled equilibrium is both appropriate for defining such a desired mole percent in the broad terms Claim 1 must have, but also unambiguous to one of ordinary skill in the art, especially in view of the aforementioned 75+ years of Diels-Alder reaction data available to such an artisan.

If on the other hand 3(b) refers to incorporation the monomer into the polymer backbone, I believe that the language used in Claims 1 and 5 is still appropriate to instruct a skilled artisan. Thus where a mixture of the two isomers is present and the isomers are incorporated into the polymer at different rates, it seems that where the rate constants are known, it would be easy to alter the initial isomer distribution to achieve the desired result in the polymer. Even where the rate constants are not initially known, it is certainly obvious that without undue experimentation the effect of differing incorporation rates can be determined and the initial isomer distribution readily adjusted.

Turning to now to 3 (c), the reference to "precursors" and "expected isomer formation" are again, I believe unclear, however as stated above, since Claims 1 and 5 both recite a desired exo mole percent for at least one of the polycyclic olefin derived repeat units, I believe that given the teachings of the subject application, one of ordinary skill in the art would understand such claim to provide sufficient guidance to select an appropriate exo mole percent

for any appropriate polycyclic olefin derived repeat unit that will result in a photoresist composition having the desired characteristics.

In 3 (d) the statement that "the lack of the amounts of the isomer components used to polymerize the units" is, I believe quite unclear and only calls to mind that the Action is referring to the relative amounts of individual types of repeat units incorporated into the polymer. If this is the intended meaning, then again I believe Claim 1 to be clear and unambiguous. Claims 1 and 5 both appropriately provide that the amount of such a repeat unit to be incorporated into the polymer is the *desired* exo mole percent necessary to provide the polymer with a desired dissolution rate. I believe that as this amount can be readily determined by a calculation based on prior routine experimentation (see, Table 1 of the instant application) or by preparing a table of dissolution rate data specific to the repeat units of a polymer an artisan selects for any specific application. Therefore I again believe that Claims 1 and 5 of the instant application do not have an ambiguous scope. .

6. In summary, I believe that Claims 1 and 5 of the instant application and Claims 3-11 which respectfully depend directly or indirectly therefrom, are clear, unambiguous and appropriate for defining the scope of an invention that is pioneering in its discovery that the dissolution rate of a polycyclic olefin based polymer can be controlled by selecting at least one type of repeat unit having a desired exo mole percent for incorporation into such a polymer

7. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

July 2, 2006

Date

Andrew Bell

Andrew Bell, Ph.D.

Appendix 'A'

Thermodynamic reaction control

From Wikipedia, the free encyclopedia

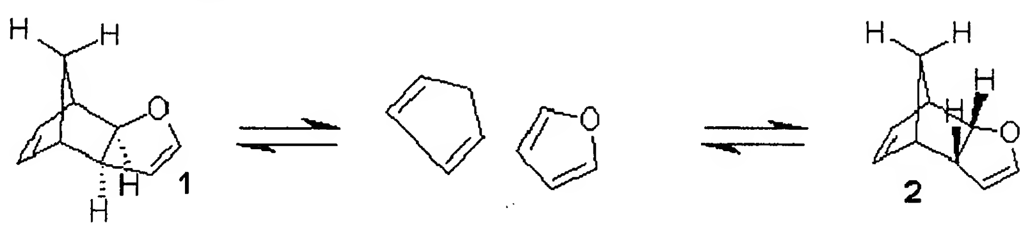
Thermodynamic reaction control or **kinetic reaction control** in a chemical reaction can decide the composition in a reaction product when competing reactions lead to different products under different reaction conditions. The distinction is relevant when product A forms faster than product B (The activation energy for A is lower than that of B) but B is a more stable product than A.

Reactions are considered to take place under thermodynamic reaction control when the reverse reaction is rapid and the Chemical equilibrium establishes itself quickly. In this way the thermodynamically more stable product is always favoured. Thermodynamic reaction control takes place with vigorous reaction conditions or when the reaction is allowed to continue over a long time to give a slow reaction time to reach equilibrium.

In kinetic reaction control the reverse reaction does not occur or is slow. In this way a product may be formed that is less stable but this product is formed faster because the activation energy for this reaction is lower. Kinetic control is favoured with milder and low temperature reaction conditions.

Examples

- The Diels-Alder reaction of cyclopentadiene with furan serves as an example. At room temperature kinetic reaction control prevails and the less stable endo isomer 2 is the main reaction product. At 80°C and long reaction time the chemical equilibrium can assert itself and the thermodynamically stable exo isomer 1 is formed.



- In the protonation of an enolate ion the kinetic product is the enol and the thermodynamic product is a ketone.
- In carbohydrate acetalisation choice of acetone precursor determines reaction outcome.
- The electrophilic addition reaction of hydrogen bromide to 1,3-butadiene at 60°C leads predominantly to the thermodynamically stable 1,4 adduc bromo-1-butene but decreasing the reaction temperature to -60°C favours the kinetic 1,2 product 1-bromo-3-butene.

Appendix 'A' con't

References

- Organic Chemistry, 3rd ed., M. A. Foxe & J. K. Whitesell, Jones & Bartlett, 2004 ISBN 0-7637-2197-2
- A Guidebook to Mechanism in Organic Chemistry, 6th Edition, Peter Sykes, Pearson Prentice Hall, 1986. ISBN 0-582-44695-3

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